

Technology Safety Data Sheet

Ribbon NAPL Sampler

Section 1: Technology Identity

Technology Name(s):		Emergency Contact:
NAPL Ribbon Sampler		Brian Riha
Manufacturer's Name and Address:		Information Contact:
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Date Prepared:	TMS Number:	Prepared By:
February 2002	TMS # 2238	Jeana Harrison (304-284-9129); Chip Booth, MS; John Kovach, MS - Operating Engineers National Hazmat Program; Mary Jenison, MS – DOE Office of Science and Technology

Section 2: Technology Pictures and Diagrams



Figure 1: A stain on a ribbon impregnated with Sudan IV.

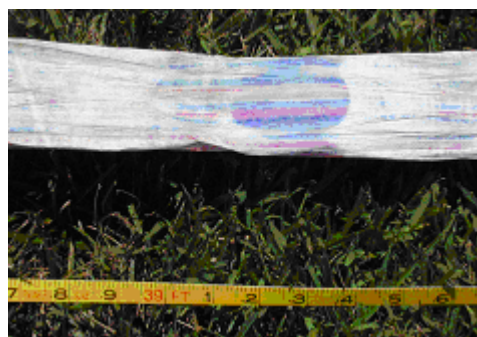


Figure 2: A NAPL stain on an indelible ink ribbon



Figure 3: The hand crank used to retrieve the sampler from the borehole.



Figure 4: The NAPL Ribbon Sampler with indelible ink.

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Section 3: Technology Description

The Ribbon NAPL Sampler is an innovative technology used to find Non-Aqueous Phase Liquids (NAPL) in the ground. These chemicals include trichloroethylene (TCE), carbon tetrachloride (CCl₄), creosote, coal tar, gasoline, fuel oil, and aviation fuel. NAPL's tend to migrate in small globules through the soil toward the water table and are considered a long-term groundwater contamination source.

The Ribbon NAPL Sampler utilizes a reusable membrane system called FLUTe® (Flexible Liner Underground Technologies) to deploy a hydrophobic ribbon in the ground. It is a method for determining the position and depth of NAPL in place. The Ribbon NAPL Sampler can be deployed via the open borehole method or with a cone penetrometer. The open borehole method is generally used in non-collapsing vadose zones, while the cone penetrometer method is ideal for collapsing sediments and for sampling below the water table. The Ribbon NAPL Sampler is the only *in situ* method for determining the location of NAPL in the ground.

The sampling technique uses a ribbon with stripes of indelible ink or coated with one of four dyes (Disperse Violet 26, Disperse Red 277, Disperse Red 86, and Disperse Orange 32). The inks and dyes replace the former dye, Sudan IV, which is a possible human carcinogen. The new inks and dyes are considered to be non-hazardous. The ribbon is generally contained within the FLUTe® membrane. It comes into contact with the ground when it is everted from the membrane and pressurized with air or water. Pulling a tether attached to the bottom of the membrane retrieves the sampler. When the tether is pulled, the sampler inverts, causing the ribbon to go inside the membrane. This protects the ribbon from cross-contamination.

Section 4: Safety Hazards

Hazard Category:

- 4 - Could result in death or permanent total disability
- 3 - Could result in permanent partial disability or injuries or occupational illness that may result in hospitalization of at least three persons
- 2 - Could result in injury or occupational illness resulting in one or more lost work days
- 1 - Could result in injury or illness not resulting in a lost work day
- N/A - Is not applicable to this technology and poses no appreciable risk

A. Buried Utilities, Drums, and Tanks

Hazard Rating: N/A

Buried utilities, drums, and tanks are not directly involved during the use of the Ribbon NAPL Sampler. These may be an issue when the cone penetrometer is used or a borehole is drilled.

B. Chemical (Reactive, Corrosive, Pyrophoric, etc)

Hazard Rating: N/A

Contamination from the NAPL in the ground is minimal.

C. Confined Space

Hazard Rating: N/A

Confined space is not a hazard associated with this technology.

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D. Electrical	Hazard Rating: N/A
No electricity is used to operate the Ribbon NAPL Sampler. Electricity may be used for the cone penetrometer or the borehole drilling. Appropriate lockout/tagout procedures should be in place when electricity is used.	
E. Explosives	Hazard Rating: N/A
Explosives are not used with this technology.	
F. Fire Protection	Hazard Rating: N/A
Although the risk of fire from this technology is minimal, personnel should be aware of any fire protection procedures already in place at each site.	
G. Gas Cylinders	Hazard Rating: 1
Compressed gas cylinders should be properly stored and maintained in accordance with Occupational Safety and Health Administration (OSHA) standards 29 CFR 1926.350(a)(9) and 29 CFR 1910.101.	
H. Ladders/Platforms	Hazard Rating: N/A
Neither ladders nor platforms are used with this technology.	
I. Lockout/Tagout	Hazard Rating: N/A
Although there are no lockout/tagout procedures needed for this technology, the deployment method may require a lockout/tagout procedure of its own. Operators should be trained in these procedures.	
J. Mechanical Hazards	Hazard Rating: 1
There are several pinch points associated with the cone penetrometer method of installation of which workers should be aware.	
K. Moving Vehicles	Hazard Rating: 1
Vehicles will be used to move the sampler and to bring workers to the site. If the cone penetrometer deployment method is used, a cone penetrometer truck will be needed at the site, as well as the trailer that carries the steam cleaner used to clean the cone penetrometer rods as they are raised from the ground. Drivers should be aware of other workers on site. Drivers should also be wary of adverse weather conditions that may affect driving.	
L. Overhead Hazards	Hazard Rating: N/A
No overhead hazards are associated with this technology.	

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M. Pressure Hazards	Hazard Rating: 1
<ul style="list-style-type: none"> Compressed gas cylinders are only used during the cone penetrometer deployment method. A low pressure of 15 pounds per square inch (psi) above water pressure is generally all that is needed. Pressurized canisters are used to deploy the Ribbon NAPL Sampler into an open borehole. The pressure needed should not exceed 8-10 psi. 	
N. Slips/Trips/Falls	Hazard Rating: N/A
The work environment will always be outdoors, so weather is a factor. The risk of slips, trips, and falls increases during bad weather.	
O. Suspended Loads	Hazard Rating: N/A
There are no suspended loads for this technology.	
P. Trenching/Excavation	Hazard Rating: N/A
Trenching and excavation are not a part of this technology.	

Section 5: Health Hazards

A. Inhalation	Hazard Rating: 1
Inhalation hazards may be present if NAPL should volatilize upon the release of the sampler and/or the cone penetrometer. A steam cleaner is used with the cone penetrometer to clean the rods before they are brought into the truck. No air sampling has been conducted to determine whether any airborne hazards exist. It is recommended that sampling take place in order to protect workers from possible exposures to carcinogenic chemicals.	
B. Skin Absorption	Hazard Rating: 1
<ul style="list-style-type: none"> It is possible that chemicals from the cone penetrometer or the Ribbon NAPL Sampler will be absorbed into the skin. Wipe samples should be taken to determine whether the cone penetrometer rods or the sampler is contaminated. A tear in the sampler may allow contaminants to leak into the clean water inside the membrane. Proper precautions should be taken. PPE and training should be provided to all workers who use this equipment. 	
C. Noise	Hazard Rating: 1
This technology does not produce noise. The cone penetrometer truck and ram do generate noise. Noise sampling should be conducted to determine whether hearing protection is needed.	
D. Heat Stress/Cold Stress	Hazard Rating: 1
<p>This technology does not produce heat or cold, but is used in an outdoor environment.</p> <ul style="list-style-type: none"> Workers should be aware of the signs of heat and cold stress. Workers should be aware that personal protective equipment might add to heat stress. 	

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E. Ergonomics	Hazard Rating: 1
<ul style="list-style-type: none"> Pulling the Ribbon NAPL Sampler from the ground may require excessive force. Workers should be trained on proper pulling techniques, in order to reduce or eliminate strains and pulled muscles. When using the open borehole method of deployment, a hand crank is used to deploy the Ribbon NAPL Sampler into the ground. Turning of the hand crank is a repetitive motion and may cause strain in the upper arm, shoulder, or back. 	
F. Ionizing Radiation	Hazard Rating: N/A
Ionizing radiation is a site-specific hazard.	
G. Non-ionizing Radiation	Hazard Rating: N/A
Non-ionizing radiation is a site-specific hazard.	
H. Biological Hazards	Hazard Rating: N/A
There are no biological hazards associated with this technology.	
I. Other	Hazard Rating: N/A
None	

Section 6: Phase Analysis

A. Construction/Start-up
<ul style="list-style-type: none"> There are several pinch points associated with the cone penetrometer where workers' fingers may be pinched. Other hazards may exist for the construction of the borehole or the deployment of the cone penetrometer.
B. Operation
<ul style="list-style-type: none"> Skin may become contaminated with NAPLs due to the handling of equipment or the ribbon. Workers should wear impermeable gloves, such as nitrile gloves, when handling the equipment or used ribbon. Heat/cold stress is a possible hazard since the technology is used in the outdoors. Workers should be aware of the signs and symptoms of both stressors. Pulling the Ribbon NAPL Sampler from the ground may require excessive force. Workers should be trained on proper pulling techniques, in order to reduce or eliminate strains and pulled muscles. When using the open borehole method of deployment, a hand crank is used to deploy the Ribbon NAPL Sampler into the ground. Turning of the hand crank is a repetitive motion and may cause strain in the upper arm, shoulder, or back.
C. Maintenance (Emergency and Routine)
Due to the simplicity of this technology, no emergency or routine maintenance is necessary.

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D. Shutdown (Emergency and Routine)

Compressed gas cylinders are occasionally used during the operation of the Ribbon NAPL Sampler. They should be properly stored and maintained in accordance with OSHA standards 29 CFR 1926.350(a)(9) and 29 CFR 1910.101.

E. Decontamination/Decommissioning

The use of a steam cleaner to decontaminate the system may cause its own hazards, which are not outlined in this document.

Section 7: Worker Protection Measures

A. Exposure Monitoring

- Air sampling should be conducted to determine whether contaminants exist during the sampling process.
- Wipe sampling of the cone penetrometer rods is important to determine whether contamination exists on the rods after the steam-cleaning process.

B. Worker Training

Workers should be trained on the following:

- Operating procedures for both methods of deployment
- Proper personal protective equipment needed for the job and proper use of the equipment
- Proper ergonomic positioning when pulling the sampler out of the ground
- Handling of compressed gases
- Recognition of heat and cold stress
- Site fire protection plans
- Lockout/tagout procedures for the cone penetrometer or borehole drilling device

C. Medical Surveillance

No additional medical surveillance is required unless noise sampling indicates that hearing protection is required. OSHA requires audiograms for workers in a hearing conservation program.

D. Engineering Controls

Mechanizing the hand crank used for the borehole method will significantly reduce ergonomic stress on the worker.

E. Administrative Controls

No additional administrative controls are recommended beyond those listed in the operating procedures.

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F. Personal Protective Equipment

- Impermeable gloves, such as nitrile gloves, should be used when handling the ribbon or a contaminated membrane.
- Hearing protection, such as earplugs or muffs, should be used if noise sampling shows noise levels above 85 decibels (dBA).

Section 8: Emergency Preparedness

Workers should be trained on the emergency preparedness procedures in place at each site.

Section 9: Comments, Lessons Learned, and Special Considerations

- Overall, this technology requires little worker intervention and is generally safe. If properly trained, workers should be able to use the Ribbon NAPL Sampler with no safety or health problems.
- Workers should be aware of the safety and health hazards associated with the installation methods (open borehole and cone penetrometer), which may not be listed in this TSDS.